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ABSTRACT

The major in most colleges has been criticized as little more than a gathering of courses taken in one department, lacking structure and depth or emphasizing content to the neglect of inquiry on which the content is based. This report, based on the "Re-Forming Majors" project of the Association of American Colleges and Universities, presents descriptions of major programs that have established clear goals, a shared sense of collective purpose, and a discernible sense of progression through the major. In these programs, faculty members have created a spine of common courses that provide students with educational milestones and intellectual community throughout their programs. Faculty focus on the intellectual tasks or practices that students ought to undertake across their course of study, which provides a map for faculty members as they plan course assignments. This report lists curricular and pedagogical innovations undertaken in humanities, social sciences, and science and mathematics. The report also offers information on how reform was implemented by specific departments, in English, foreign languages, history, psychology, economics, sociology and anthropology, physics, biology and environmental studies, and mathematics. The reform efforts focus on encouraging connected learning, restructuring the sequence of course paths, re-organizing laboratory work, integrating the use of new technologies, incorporating problem-based learning, and other approaches. (JDD)

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ED 379 997

Changing the Major

Innovation Priorities in the Fields

HE 028 112

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Changing the Major

Innovation Priorities in the Fields

We present this report on *Changing the Major* with a mix of pleasure, pride, and high hopes that the good work described here will stimulate fresh thinking and further generative work in thousands of arts and sciences departments across the country.

Capsulized in the pages that follow are some of the most interesting accomplishments of several dozen arts and sciences departments that participated in AAC&U's national project, Re-Forming Majors. We hope you will share our sense that, collectively, the changes described here represent a significant breakthrough for the departments that introduced them and for curricular designs in all arts and sciences majors. The "lead institutions" (see page 24) that undertook this work are exploring the next frontier for curricular renewal beyond the general education reviews already undertaken.

Challenging the Muddle in the Middle

Ten years ago, the national report, *Integrity in the College Curriculum: A Report to the Academic Community*, provided an unstinting critique of the arts and sciences major. "Indeed, the major in most colleges is little more than a gathering of courses taken in one department, lacking structure and depth, as is often the case in the humanities and social sciences, or emphasizing content to the neglect of the essential style of inquiry on which the content is based, as is too frequently true in the natural and physical sciences." (*Integrity* 1985, 2)

At AAC&U, we have come to call this missing sense of focus and structure "the muddle in the middle." First courses in the major are endlessly reworked, often in the context of general education reviews. Many departments now have capstone courses. But what is the purpose of all the courses in between? How do middle-level courses relate to the first course in the major? To the capstone course or senior seminar? To one another? Too often students are left on their own to connect what the faculty has not.

By contrast, the major programs described in these pages have established clear goals, a shared sense of collective purpose, and a discernible sense of progression through the major. Faculty members have created a spine of common courses that provide students with educational milestones and intellectual community throughout their programs. Adding to this sense of community, students have been actively involved both in the departmental reviews that accompanied these revisions and in ongoing discussions about proposed and implemented changes.

Serendipitously, the many hours of faculty discussion about re-forming majors have also created a richer com-

AAC&U PROJECTS ON RE-FORMING THE MAJOR

The work reported in this publication builds on AAC&U's earlier review of purposes, practices, and needed changes in arts and sciences fields. That review involved an intensive national study of a dozen arts and sciences majors, ranging from physics to women's studies. Findings were published in three volumes: *The Challenge of Connecting Learning*, *Reports from the Fields*, and *Program Review and Educational Quality in the Major: A Faculty Handbook*. (For information on ordering, see page 23). In these publications, AAC&U argues for:

1) a conception of the major as an inclusive learning community, in which each student's intellectual development is deliberately cultivated and supported and diverse participation is both valued and sought;
2) a spine of common courses and/or experiences in every major program, including a developmental focus on teaching students to use the analytic approaches of their field to deal with complex problems and issues;
3) a commitment to "connected learning" including (a) integrative learning within the major; (b) integration between the major and general education; and (c) integration between the major and the student's commitments beyond the academy;
4) the development of critical perspectives on the approaches of one's field, including opportunities to consider issues through multiple disciplinary lenses, with attention to the limitations of any one approach.

Overview
3 Re-form Priorities in Arts and Sciences Majors

Humanities
4 English
7 Foreign Languages
8 History

Social Sciences
11 Psychology
12 Economics
13 Sociology/Anthropology

Science and Mathematics
15 Physics
18 Biology
20 Mathematics

munity of purpose between senior members of a department and younger, often untenured scholars. Many younger faculty members in the project told us that the department's decision to re-form the major provided them with their first opportunity to raise their own questions about inherited practices in their majors—and to advance their own ideas, both about new content and new educational designs.

A New Focus on Intellectual Tasks and Practices

Significantly, many of the departments involved in Re-Forming Majors have found ways to create this sense of clear purpose while still allowing students great freedom in choosing the subject matter of most of their courses in the major. The breakthrough has come from faculty *focus on the intellectual tasks or practices* that students ought to undertake across their course of study. As readers will see from the several examples presented here, faculty have asked, "What ought to be in each student's 'intellectual portfolio' of work by the time the major is completed?" They have then assigned specific levels of intellectual tasks to introductory, intermediate, and advanced courses.

This focus on intellectual tasks appropriate to particular levels of coursework provides a map for faculty members as they plan course assignments that help students learn to use the approaches of their field in analysis, interpretation, and problem solving. It provides a framework for students to use in checking their own capacity to use a field's approaches and methods. It shifts the emphasis in organizing a major from "what is covered" to increasing sophistication in using the field in work of one's own. Usefully, this new focus provides a foundation for assessment that takes into account students' markedly individualized paths through a major.

Preparing Students for Advanced Work in their Fields

Too often, students can take several courses in a major without ever doing either a significant piece of research or independent analysis, or *any of the preparatory tasks that must be mastered for advanced work to be worthy of the description*. The results are predictable. Students are often unable to do the work expected in a capstone course because there was not sufficient preparation earlier in the major. The curricular designs described here productively address this chronic faultline in arts and sciences majors across the country.

About the Re-Forming Majors Project

Begun in 1992 with generous support from the U.S. Department of Education Fund for the Improvement of Postsecondary Education, the Re-Forming Majors project linked eight "lead campuses" (see page 24) competitively selected to work on needed changes in their arts and sciences majors. Each of these lead colleges and universities had already made significant progress in rethinking their goals for undergraduate education. Several had implemented comprehensive general education revisions; some had also introduced innovative assessment activities; some had made a significant investment in improving teaching. These prior accomplishments were important foundations for re-forming majors. AAC&U will report in a forthcoming study on the particular strategies these institutions used to involve groups of departments in simultaneous reviews and renewal of their student majors.

The work described here marks the latest milestone in AAC&U's continuing work on purposes and practices in college majors. In 1988, with support from the U.S. Department of Education Fund for the Improvement of Postsecondary Education and the Ford Foundation, AAC&U (then the Association of American Colleges) began a collaboration with twelve learned societies to reexamine educational goals for college majors as liberal learning and to recommend needed changes in specific arts and sciences fields. (See box on page 1 for information on these recommended changes.)

Unfinished Designs: The Challenge of Pluralism

The departments in the Re-Forming Majors project made great progress in addressing the second and third of AAC&U's core recommendations for strengthening majors as liberal learning (see page 1). Departments addressed only partially, however, the first recommendation—to seek and value the participation of diverse students. Many departments expanded the intellectual content of their major to include world and/or U.S. diversity. But far fewer reported systematic efforts to discern who chooses the major, who does not, and how a department might cultivate a more inclusive student participation. Similarly, only a few departments made world and/or U.S. diversity an integral organizing principle for the spine of common courses and experiences they wove through their majors. The perception that diversity is an add-on in many fields is itself a barrier to diverse participation in that field.

Arts and sciences majors seem similarly resistant to the recommendation that they help students develop a critical perspective *on* their field, exploring its limitations as well as its strengths and grappling with advanced problems through multidisciplinary, rather than monodisciplinary lenses.

The role of multidisciplinary and interdisciplinary experiences in a student's advanced study is one that still awaits significant attention from the academy. Many institutions now offer advanced, problem-oriented, multidisciplinary general education courses. But these courses tend to parallel, rather than engage, the advanced work of the major.

Clifford Geertz has reminded us that "multiplicity is the hallmark of modern consciousness." Helping students learn to grapple with multiplicity—societal, intellectual, disciplinary—remains the next significant challenge for the contemporary arts and sciences major.

RE-FORM PRIORITIES IN ARTS AND SCIENCES MAJORS: AN OVERVIEW

The next sections of this report provide information on curricular and pedagogical innovations undertaken in specific fields and majors under the auspices of the Re-Forming Majors project. Here we provide an overview of broad curricular and pedagogical trends apparent across the humanities, social sciences, and science and mathematics fields in the project. Most of these re-form priorities are consistent with recommendations for change in the major developed by learned societies and published by AAC&U and ten separate societies (see page 23 for information on ordering *Reports from the Fields*). Other priorities reflect departments' determination to develop students' repertoire of analytical and problem-solving skills and to help students see connections between their learning in their majors and in the world of work.

Humanities

- Shift from canonical content coverage to skills and critical approaches as organizing principles for the major
- Introduction of interpretative and critical approaches early in the major
- Increased attention to previously neglected literatures and histories including world cultures, literature from British colonies, and the histories and cultures of minority groups in the U.S.
- Development of public forums at which students can present their work
- Development of more effective advising materials and practices
- Portfolios as assessment tools and opportunities for students to reflect on the discipline and integrate their work in the major
- Peer review of written work
- Development of capstone assignments that enable students to reflect in writing on their experiences with the disciplines
- Increased use of technology including computer-assisted writing labs and interactive electronic technologies to create learning communities within majors

Social Sciences

- Student involvement in evaluating and changing the major
- Shifting of methodology courses to points earlier in students' progress through the major
- Creation of multiple gateway courses to better introduce transfer students into major programs
- Integrating research and writing across the major
- Development of student portfolios as assessment tools and places for students to reflect on and integrate their learning
- Institution of multicultural and global content requirements
- Fostering a sense of community through student surveys and clubs
- Increased use of technology to enable students to pursue integrative research projects
- Increased opportunities to do field research and internships
- Development of integrative capstone experiences for all majors

Science and Mathematics

- Redesign of introductory courses to make them gate-openers rather than weed-out courses
- Bridge courses in specific skills development to facilitate students' movement to higher-level courses
- Expanded and more pedagogically innovative uses of new technologies and collaborative learning across the major
- Increased development of undergraduate research and internship opportunities
- Creation of opportunities for public presentations of student work
- Problem-based capstone courses
- Courses that introduce the history of the discipline, often in capstone experiences
- Development of interdisciplinary courses that provide students with opportunities to connect their learning across related disciplines and general education

ENGLISH

Five English departments in the project undertook re-form in the major, revising their goals and expected learning outcomes and restructuring curricula to address updated goals. English departments have traditionally organized the major around literary periods, authors, and genres. These five departments developed a new "double" focus, weaving explicit attention to students' analytic and methodological competence into new designs for content coverage.

Recurring themes across the five revisions included:

- approaches to curricular coherence that focus on developing analytic and critical skills across the major rather than through topical coverage alone;
- strong emphasis on developing ways to encourage students' active learning;
- innovative approaches to assessment and special attention to the needs of transfer students; and
- increased attention to previously neglected literature including literature from British colonies and minority cultures in the U.S.

Student Involvement in Re-Form Efforts

Students have contributed effectively to the re-form measures undertaken by English departments within the project. Departments provided questionnaires to students about their expectations and experiences as majors; students also participated in follow-up discussion groups as part of the review process. Some departments organized specific events, like a senior luncheon at Western Michigan University at which students could discuss their experiences as English majors. These discussions contributed significantly to students' increased sense of ownership and involvement in their major programs.

Such discussions led some departments to develop new "guides to the major" to help students plan a coherent course of study tailored to their own goals. At Iona College, the department responded to student career concerns with internal internships placing English majors in positions on campus in public relations, advancement, and on *The Shakespeare Newsletter*. Western Michigan University will use middle-level survey courses in British and American literature as the entry point for transfer students.

New Approaches to Curricular Coherence

Each department envisions a sequence of courses that helps students understand and practice the field's analytic and critical methods. Entry-level courses provide an introduction to these methodologies which is reinforced in subsequent required courses in the major.

At Manhattan College, a "critical vocabulary" is built into the major core sequence of four courses. This vocabulary is then expanded through a three-course sequence at the middle level. Manhattan has also incorporated more

COLLEGE OF CHARLESTON
English Department Sequence of Courses

English 290: Introduction to Literary Studies
(Principles and practice of literary interpretation and research methodology)

↓

English 3XX
(Courses which emphasize primary texts and interpretation; no research required)
English 3XX.R
(Courses which require research and familiarity with critical discourse)

↓

Senior Symposium
(Formal public presentation of a work of original literary criticism)

English 201 and 202: Major British Authors
(Close readings of canonical authors and lectures on intellectual history)

↓

English 301(.R) or 302(.R): Shakespeare
English 304(.R) or 306(.R): Chaucer or Milton
English 205, 342(.R), or 343(.R): Early American Literature
English 206, 344(.R), or 345(.R): Later American Literature
A pre-eighteenth-century course
An eighteenth- or nineteenth-century course
A twentieth-century course

Courses in bold are required. *Courses in italics are strongly recommended.*

ENGLISH

The following syllabus represents one example of how departments are reorganizing gateway courses around literary methodologies and critical approaches rather than around canonical content coverage.

DICKINSON COLLEGE
English 220
Critical Approaches and Literary Methods
Professor Wendy Moffat

Required Texts:

Abrams, *A Glossary of Literary Terms*
Austen, *Pride and Prejudice*
Booth, *Shakespeare's Sonnets*
Fish, *Is There a Text in this Class?*
Dickinson, *Final Harvest*, ed. Johnson
Lentricchia, ed., *Critical Terms for Literary Study*
Shakespeare, *Macbeth*
Selected articles to be distributed

Course Objectives:

We will explore various methodological approaches to the reading of literature, identify the conflicts inherent in issues of validity in interpretation, and work toward each student developing a self-conscious critical stance.

Course Requirements:

Student participation will be a key element in this course. I plan to run the class as a seminar, with class discussion rather than lectures. In the past, students have found the readings to be difficult, and different in kind from other literature classes. To be prepared for class may mean that you will have to read the assignment several times; I recommend making an outline or précis of the reading to bring to class with questions. Before coming to class you should use reference works to look up terms or concepts which seem difficult. I welcome your questions and comments on the e-mail systems.

Writing:

There will be three papers and a take-home final exam. In addition, I may ask you to complete short writing assignments to focus discussion.

Course Outline:

Session 1	Introduction
Session 2	What is literary criticism?
	New Critical Assumptions
Session 3	Jane Austen, *Pride and Prejudice* (to Chapter 43)
	Abrams: "persona, genre, interpretation, criticism, characters, irony"
Sessions 4/5	Jane Austen, *Pride and Prejudice* (finish)
Sessions 6/7	Wimsatt, "Intentional Fallacy" and "Affective Fallacy" from *The Verbal Icon*
	Jane Austen, *Pride and Prejudice* (continued)
Sessions 8/9	Kavanagh, "Ideology"
	The Reader and Meaning
Session 10	Fish, *Is There a Text in this Class?* (chapters 1 and 11)
Session 11	Fish, *Is There a Text in this Class?* (chapters 13–15)
Session 12	Jane Tompkins, "The Reader in History"
Session 13/14	Booth, *Sonnets*
	Abrams, "sonnet, alliteration, figurative language, ambiguity, imagery, stanza, meter, rhetorical figures"
Session 15	*Sonnets*, Booth's interpretive essays
Session 16	*Sonnets*, Patterson, "Literary History"
Session 17	Problems of Textual History: Questions after Booth
	Author and Intention
Session 18	Dickinson, Selected Poems as Problems
Session 19	Dickinson, Selected Poems
Session 20	Hirsch, "Objective Criticism"
Session 21	Patterson, "Intention"
	Barthes, "The Death of the Author"
Session 22	"What if they don't cooperate?"
	Selections from Davis, *Resisting the Novel*
	Fetterly, *The Resisting Reader*
	de Man, "The Resistance to Theory"
	New Contexts, New Questions
Session 23	Greenblatt, "Culture"
	Guillory, "Canon"
Session 24/25	*Macbeth*
Session 26	Conclusion

research methods with increased use of critical sources into its entry-level course. Western Michigan University also has shifted to skills as a primary organizing principle in its entry-point courses. The department now includes terminology, methodology, and critical writing in its entry-level course on "Literary Interpretation."

Events at which students could discuss their experiences as English majors contributed significantly to an increased sense of ownership and involvement in their major programs.

The guiding principle of the entire major at Dickinson College is the teaching of "ways of reading texts." Two new introductory courses, "Texts and Contexts" and "Critical Approaches and Literary Methods," examine the ideological assumptions implicit in selected texts and the variety of critical approaches currently used in literary studies. These interpretive courses set a context for middle-level courses which have historical or chronological organization.

The department at the College of Charleston has instituted a revised sequencing of courses that helps ensure that students have mastered designated critical thinking skills and specific research methods at particular points in their program. The department has integrated this methods sequence with its content coverage requirements. Faculty members also have incorporated a variety of new texts representing the literatures and cultures of women and minority groups in the U.S. and in British colonies into their content coverage courses.

An issue-based research capstone course at Jacksonville University draws together the critical thinking skills and various approaches in literary criticism that have been incrementally built through the duration of the program. This course will also include the opportunity for advanced research. At Jacksonville University, the department also enables students to make connections from their major courses to other parts of the curriculum by defining tracks with suggested minors and electives based on students' career and graduate interest goals. Jacksonville University also maintains portfolios of student writing to assess progress in attainment of various kinds of writing skills.

Several departments are also integrating thematic rather than chronologically organized coverage courses and including literatures from English-speaking countries other than the U.S. or Great Britain.

JACKSONVILLE UNIVERSITY
English Department Course Sequence
and Writing Skills

COURSE SEQUENCES	POTENTIAL PORTFOLIO WRITINGS
200 Level	
American Literature British Literature I and II World Literature Introduction to Film History	Interpretation of Primary Sources Interpretation of Primary Sources with Limited Use of Secondary Material Summary of Literary Critical Approaches and Some Elementary Application of Approaches
300 Level	
Advanced Writing Courses (Expository, Argument, Creative) Genre Courses (Novel, Poetry, Drama) Historical Periods	Précis Analogy Writing Case/Research Studies Analysis Self-Explication Feature/Interview Writing Book Reviews Narrative Writing Descriptive Writing Annotated Bibliographies Cross-Curricular Writing Policy Writing Fact-Value Writing Observational Writing Speech Writing Group Writing Projects Problem/Solution Writing Letters, Memos Personal Essay Cause/Effect Writing Comparison/Contrast Writing Evaluation Writing
400 Level	
Contemporary Literary Theory Major Authors and Special Topics, Language Courses Research and Writing Capstone Seminar Internships	Extensive Research Essays Major Research Project Abstracts Bibliographic Essays Periodic Literature Review Research Proposals

FOREIGN LANGUAGES

Shifts in Undergraduate Goals for Language Learning
Students' interest in practical language skills, the broader study of cultures, and international/intercultural communication is driving re-form efforts in foreign language majors. These new emphases are having a transforming effect on modern language programs, but they leave open important questions about the overall purpose and substance of a language major.

Traditionally, at least for Western European languages, linguistic proficiency has been an intermediate goal that leads to the study of literature as the culminating work in the major. Yet decreasing numbers of undergraduates are interested in a major whose focus is the canonical literature of the field. Students seek language proficiency and intercultural communication. In this project, as in other departments across the country, faculty members have worked on ways to foster high levels of language proficiency. Assessment of students' linguistic competence is becoming an important organizing principle for work in the major. Faculty members have also worked to integrate the study of culture into all foreign language courses, minimize cultural stereotypes, and increase intercultural knowledge and awareness.

Student Involvement in Setting Re-Form Agendas
Schools in the project have surveyed students and paid close attention to their learning and career goals while revising foreign language programs. Departments find increasing student interest in courses that deal with the cultures in which languages are spoken and with specialized professional vocabularies and usages. The University of Arkansas–Little Rock, for example, found that most of the students interviewed were double majors and were primarily interested in attaining speaking, cultural, and reading proficiency in the target language. Another example of the shift in focus toward practical language skills attainment is provided by the French department at the College of Charleston which is working collaboratively with a number of other programs including the business department. The department now offers a course in "Introduction to Marketing." The College of Charleston also offers a Spanish business minor.

Assessing Language Skills
At two of the schools in this project, standards set by the American Council on the Teaching of Foreign Languages (ACTFL) have provided the guides with which departments are revising the assessment components of their programs. At the University of Arkansas–Little Rock, assessments of student proficiency in four skills (speaking, listening, reading, and writing) are now integrated into programs in core, milestone, and capstone courses. The French department at Manhattan College has also developed four skills assessment "checkpoints." The department has also developed a student portfolio assessment to complement the skills assessment efforts.

Language Across the Curriculum and in the Core
Efforts to link foreign language study with other undergraduate fields, commonly known as "Language Across the Curriculum" programs, are also gaining momentum. At the University of Arkansas–Little Rock, a nine-hour core language requirement is in effect for all undergraduates. To meet general education goals, "All [language] courses [therefore] currently reflect competencies in: critical thinking, international awareness, verbal literacy, and cultural awareness." The French department at Manhattan College is also working with other disciplines to integrate French into non-language courses in the School of Arts.

Decreasing numbers of undergraduates are interested in a major whose focus is the canonical literature of the field. Students seek language proficiency and intercultural communication.

Incorporating Technology
Technology is changing classroom practice in the foreign languages as it is in fields throughout the project. Foreign language departments are making use of interactive videos, electronic networking, and other kinds of technological media to aid in instruction and in the development of language competence.

All eight of the schools participating in the re-forming majors project undertook comprehensive reviews of their history majors. Re-forming priorities included:

- greater coherence across the major achieved by emphasizing the development of historical analysis skills;
- incorporation of portfolios into majors both as assessment tools and as ways to encourage students to reflect on their progression through the major;
- development of courses and sequences, including experiential learning projects, that foster integrative learning;
- fostering of learning communities at all levels of the major through student co-curricular groups and collaborative research projects;
- greater incorporation of world history requirements and attention to women's history and to the histories of minority groups in the U.S.; and
- development of integrative learning opportunities, especially at the senior level.

Developing Coherent Paths of Study

History departments in the project worked creatively to foster greater coherence in their major programs. They developed more clearly articulated goals and outcomes for the majors and communicated them to all incoming students. They explicitly related required courses to these departmentally determined goals. Specific historical skills were incorporated as goals in individual courses at each level of a student's development through the major. Departments also linked capstone experiences to methods and content of earlier courses.

At Western Michigan University, an expanded introductory course, "Historians in the Modern World," focuses on introducing majors to basic historical methods, diverse primary sources, and various fields of history. The course emphasizes students' understanding of the type of historical skills needed as they progress to middle- and upper-level history courses. In addition, a 300-level required course, "The Study of History," has been revised to develop at a more sophisticated level students' analytic abilities in understanding historical concepts and interpreting historical writings. The course explores approaches to historical investigation and historical theory and promotes students' critical perspective on the major.

Departments also developed new student guides, checklists, and advising materials. The department at the University of Arkansas–Little Rock has put in place an expanded one-on-one advising system. Advising sessions each semester now involve more than the traditional review of the student's progress toward graduation; faculty members work to make students aware of appropriate curricular choices within the major and in potential minor fields based on students' expressed career goals. The department at the University of Arkansas–Little Rock also produces an alumni newsletter, *The History Alumnus*, that includes opportunities for alumni to provide feedback on their experiences in the program and beyond.

At Rowan College of New Jersey, a portfolio of historical writing is now required of all majors. Each student must complete no less than seven portfolio assignments, each keyed to various milestones in course sequences through the major. The portfolio is used in semiannual academic advising to provide students with a

UNIVERSITY OF ARKANSAS–LITTLE ROCK
History Department Statement of Philosophy

The study of history is a process whereby people try to make sense of past human experience and its relationship to the environment. As times change, so does our view of the past. Informed by different personal experiences, intellectual perspectives, and social concerns, each generation of historians has redefined the nature of historical evidence and found within it different patterns of behavior. These patterns not only give meaning to what has already occurred, but also provide a basis for making informed decisions in the present and constructing informed expectations of future outcomes. "Making sense of the past" involves four kinds of analytic operations:

- the posing of questions regarding such matters as periodization, causation, and motivation;
- the identification and collection of what the historical community has identified as valid historical data;
- the integration of these data into a pattern that produces what both historians and their readers would acknowledge as meaningful answers to historical questions originally posed; and
- the formulation of new questions in light of new research and recently acquired experience of the historical community.

In constructing and articulating their answers, modern historians draw upon both the methods of social science and literary conventions. It is this blending which makes history a distinctive enterprise.

coherent record of personal growth and development within their field and to help students prepare a resume.

Encouraging Connected Learning

"Connected learning" was emphasized in several ways by history departments in the project. Several departments explicitly related courses in the major to general education requirements or to institutional competency goals. Some programs developed interdisciplinary senior seminars or capstone courses or designated courses in which various kinds of external applications, including field work or internships, were incorporated.

Students are also increasingly being encouraged to reflect on the societal uses of history in the contemporary world through public history subfields or integrative, topical capstone courses. Jacksonville University, for example, developed a capstone course that has students consider various public uses of history and public controversies about the interpretation of the past. The course currently planned will cover such issues as the recent controversy over Disney's proposed commercial development of lands around the Manassas, Virginia, Civil War battlefields for a historical theme park and the controversy over the Smithsonian Institution's exhibition on the Enola Gay. This course, whose particular topics will change from year to year, has two principal objectives:

- to allow students to reflect on their role as historians in American culture and
- to give students a sense of having reached a milestone and joined the community of historians.

This course also focuses on the possibilities of demonstrat-

DEPARTMENT OF HISTORY
COLLEGE OF CHARLESTON

LEVEL	COURSE DESCRIPTORS	SKILLS GUIDELINES
100	introductory surveys	analyze and discuss primary and secondary readings; understand the historical method; evaluate historical ideas, events, individuals
200	intermediate-level courses developing historical understanding, research, and writing skills generally covering broad chronological and/or geographical areas	think and write analytically and critically using historical material; develop basic research skills; develop and defend own interpretation; examine basic bibliographic and historiographic knowledge of particular topic/region/period
300	intermediate-level courses requiring more extensive research and writing than at the 200 level generally covering more specialized chronological and/or geographical areas	use primary and secondary sources in discussions and papers; design and execute analytical research paper; develop own interpretation and defend it; improve bibliographic and historiographic knowledge of particular topic/region/period; analyze and synthesize diverse historical works
400	advanced-level courses involving major research projects	design and execute analytical research paper; evaluate peer presentations and/or papers; revise work in response to criticism; analyze and synthesize diverse historical works; develop own interpretation and defend it; refine bibliographic and historiographic knowledge of particular topic/region/period

ing and communicating the importance of history to "non-believers" and centers on a collaborative project that encourages students to consider how to converse with non-historians about history.

The department at the College of Charleston also now requires a reflective essay on the major to be included in students' portfolios. This exercise encourages students not only to reflect critically on the discipline as a field, but also on his or her own progression through a field of study.

Creating Learning Communities

Rowan College of New Jersey, Western Michigan University, and the College of Charleston each worked to create learning communities by structuring collaborative learning experiences and group projects into specific required courses. The department at the College of Charleston also requires students to present a public defense of an analytic research paper in front of their peers as one of several milestone and capstone experiences.

Students at a number of schools are also encouraged to sit on planning and curriculum committees. Several departments created or revived student clubs and honors associations to foster a greater sense of community in the department. Some departments also structured opportunities for student-to-student mentoring.

ROWAN COLLEGE OF NEW JERSEY
DEPARTMENT OF HISTORY

Major Requirement—36 Credit Hours

COURSE SEQUENCE	PORTFOLIO REQUIREMENTS
100 Level	
World History	Historical Essay
U.S. History to 1865	Documentary Analysis (Essay requiring citation of primary source materials)
Western Civilization to 1660	Abstract of one document or article
200 Level	
U.S. History since 1865 or Western Civilization Since 1660 or a 200-Level Elective	Documentary analysis using multiple genres of source materials
Global Field Survey-Level Course	Numerical Analysis (Assessment of data, charts, and tables)
Historical Methods and Materials	Graphic Analysis (Assessment of artifacts, maps, and blueprints)
300 Level	
Proseminar	Historical Abstract of a Journal Article
Global Field Upper-Level Course	Research Proposal
Free Elective	Library Research Exercises
	Bibliographic Essays
	Scholarly Book Review
	Peer Evaluation
400 Level	
Free Elective	Historical Fiction
Free Elective	Periodic Literature Review
Capstone Seminar	Video
	Research paper in field related to history
	Capstone Seminar Paper

All students are required to maintain a history portfolio. Each portfolio will include seven items in order to graduate with a B.A. in history: three from the 100–200 level, three from the 300–400 level, and the required senior seminar paper.

PSYCHOLOGY

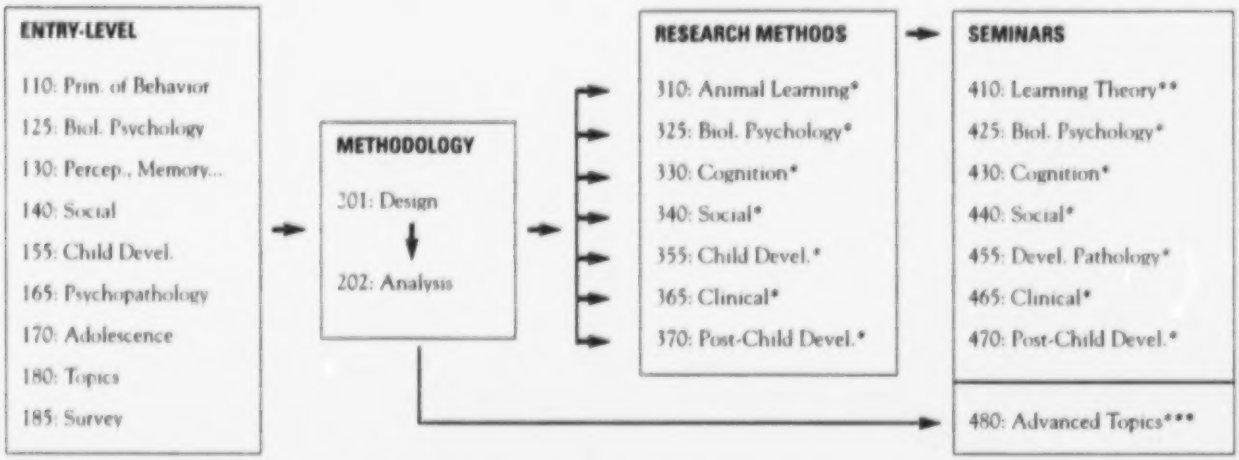
Several priorities dominated re-form efforts in psychology departments in the project. Departments have moved methodology courses earlier in the major and involved a greater portion of their faculty in teaching these courses. At Jacksonville University, courses in statistics and research methods are now requisites for all further study in the major. Departments have revised the ways in which students enter the program and, in several cases, have provided multiple entry points which also help to integrate transfer students into major programs early. Departments are increasingly incorporating computer usage into courses and are revising courses to focus on critical thinking and writing skills within the major.

Some departments have involved current and past students in the evaluation of their re-forming efforts. In response to student input, the department at the University of Arkansas–Little Rock has devised a new statement of goals that includes cognitive skills, writing skills, influences from other traditions, career options, and the role of ethics and values in psychology. Individual courses throughout the major now also incorporate an explicit articulation of which goals are addressed.

Several departments in the project developed more focused capstone experiences for their students that draw explicitly on their previous learning. Several programs also provide practical internship opportunities for students at the senior level.

At Dickinson College, before students enter a practicum or internship location, they must develop a question or problem around which their independent work, whether in independent research and writing or in a practical internship experience, can be focused.

DICKINSON COLLEGE
Department of Psychology Courses and Major Requirements



SUMMARY OF REQUIREMENTS:
Ten courses including:
Two from 110 to 185
201 and 202, in sequence
Two from 310 to 370
One from 410 to 480
One from 491 to 493
Two electives

* Students must take the corresponding 100-level prerequisite.
** Students must take the corresponding 300-level prerequisite.
*** Permission of instructor.
**** Permission of instructor; students participate in end-of-term poster session.

SENIOR EXPERIENCE
491: Practicum or Internship****
492: Independent Study****
493: Independent Research****

ECONOMICS

Three economics departments took part in the re-forming majors initiative and all made substantial changes in the emphases within their departments. Re-forming priorities included:

- computer assisted teaching and learning;
- development of integrative capstone experiences;
- attention to multiple cultures and/or perspectives within the major; and
- emphases on the practical applications of economic analysis.

The three economics departments also made notable use of students in assessing the current state of the major, assigning students to survey both majors and alumni.

Toward Integrative Learning

The department at Dickinson College geared its re-forming efforts to achieving "a greater sense of relevance in introductory and intermediate theory courses" and placing emphasis, therefore, on more applied as well as theoretical material. The department is also developing a middle-level structure to the major: students would concentrate in three or more courses in such subfields as international economic issues, public or private economic issues, quantitative economics, or heterodox economic theories.

The department also has renewed its commitment to teaching "contending economic perspectives," giving students a strong sense of the strengths and limitations of economics as one disciplinary perspective among many. The department also is heavily involved in many interdisciplinary programs: American studies, environmental studies, international studies, East Asian studies, policy studies, and Russian area studies all have specific courses in economics at the intermediate levels.

The department at Dickinson College has also begun a cooperative project with the composition and communication department, hosting a series of sessions on rhetoric in the social sciences in order to better integrate writing into their re-formed major. They have concentrated on interconnecting writing and critical thinking and on using collaborative learning as a writing methodology. Further, the department interconnects research and writing and encourages students to examine the specific nature of writing in economics. In certain writing-intensive courses, the department is making use of a linking program with the college's composition program. In designated courses, the program provides writing consultants who read and discuss with students drafts of papers.

Restructuring Paths Through the Major

The economics department at Rowan College of New Jersey has also initiated significant changes at all levels of its program. Changes are geared to provide more flexibility for students in a program that traditionally had been highly structured. The topics covered in the introductory macro and micro courses have been restructured so as to eliminate duplication of material. Computer-assisted learning has been incorporated in a variety of courses at each level of the major. The department has also proposed reducing the number of semester hours spent on required courses (from twenty-one to eighteen) to increase the number of hours students can take in economics electives (from fifteen to eighteen). The department also has instituted internship programs to provide students with a greater sense of the practical applications of the discipline and to provide them with integrative experiences using the tools of the discipline. Finally, the department now requires that student take one of two designated multicultural/global economics courses.

The economics department at Western Michigan University is also giving increased attention to issues of diversity. For example, a new course has been introduced on "Women in the Economy." Western Michigan University also has introduced a capstone course in econometrics as an integrative experience in which students "select a hypothesis to test while applying the tools they have learned in other courses." The department also has increased the number of required courses and provided more structure to its sequence of courses.

WESTERN MICHIGAN UNIVERSITY
Economics Department
New Major Sequence

Thirty hours of coursework
Twenty-one hours of required courses to include:

EC 201—Introduction to Microeconomics
EC 202—Introduction to Macroeconomics
EC 402—Economic Statistics
EC 403—Intermediate Microeconomics
EC 406—Intermediate Macroeconomics
EC 409—Introduction to Econometrics
(Capstone Course)
EC 484–Comparative Economic Systems
(Baccalaureate Writing Course)

Plus nine hours of electives numbered 300 and above selected in consultation with the undergraduate advisor.

SOCIOLOGY AND ANTHROPOLOGY

Sociology and anthropology departments in the project focused on restructuring the sequence of course paths through majors, emphasizing especially the placement of methodology courses earlier in the major and better organization of the middle-level courses. Several departments also involved students in re-form efforts by making use of sociological survey methods to ascertain students' and recent alumni's experiences with the major.

Developments in Anthropology

The anthropology department at the University of Arkansas–Little Rock radically re-formed the structure of its major. The department developed a set of fifteen objectives for the major and revised its introductory cultural anthropology course to focus on "avoiding ethnocentrism and prejudice and coming to understand and appreciate diversity." The introductory course in general anthropology introduces students to the four fields of cultural anthropology, physical anthropology, archaeology, and linguistic anthropology. Faculty members have also worked on systematizing and making more coherent their mid-level requirement and are working with the sociology department to revise an existing statistics course to make it more appropriate to the needs of anthropology students. The department has clarified the skills students should master at each stage of their development through the major.

Finally, the department is planning a team-taught capstone course on current articles and books that bridge the four fields of anthropology which encourages students to talk and write about their understanding of the major's goals.

At the College of Charleston, anthropology students begin by taking a course in each of four areas of the field before going on to concentrate in one of them. The senior course in research methods is jointly taught by an archaeologist and a cultural anthropologist, with participation by a linguist and a biological anthropologist. This kind of course provides the student with the opportunity to revisit their 200-level courses in a more sophisticated and integrated context.

Developments in Sociology

In sociology departments, as in the other social science disciplines, methodologies are being introduced earlier in the major and reinforced throughout, giving students repeated and increasingly more sophisticated opportunities to apply the methodologies of the discipline. Offering these courses earlier in the major also helps to integrate and accommodate the large numbers of transfer students many programs have.

UNIVERSITY OF ARKANSAS–LITTLE ROCK
Anthropology Department Skills Development Overview

COURSES	SKILLS DEVELOPMENT
Lower Level	1. state a problem and ask a question
Introduction to Anthropology	2. formulate a research question
Cultural Anthropology	3. write, or, more specifically, articulate and organize thoughts and abstract ideas
Physical Anthropology	4. engage in informal oral presentations
	5. identify current problems in newspapers, magazines, books, and other sources that might have anthropological solutions
	6. critique articles through answering guided questions
	7. understand some basic notions in science: hypothesis, theory, testing hypotheses, generating hypotheses
Upper Level	1. conduct a literature search (and use AA/AE style)
Anthropological Theory	2. write an annotated bibliography
Archaeology	3. critique anthropological works
Linguistic Anthropology	4. interview
Statistics	5. conduct participant observation in settings they are strangers to
Ethnographic Methods	6. conduct library research including formulation of a question and presentation of current knowledge on a topic
Electives	7. using research methods of physical, cultural, archaeological, or linguistic anthropology to, (1) formulate and justify a research question; (2) collect, examine, and analyze data; (3) articulate conclusions in both written and oral forms
Capstone Course	

1. Student must take thirty-two credit hours. The four fields, theory, and capstone courses will be required. Statistics and Ethnographic Methods will be strongly recommended.
2. Courses in **bold** are required courses.
3. Evidence of the skills listed for upper-level courses are portfolio requirements, but we encourage students to include all their work.

At the College of Charleston, for instance, the department requires three 200-level courses dealing with social institutions, social thought, and research methods. These courses provide students with theoretical background and skills they later apply in 300-level electives and revisit in their capstone courses. The department at the University of Arkansas–Little Rock restructured two middle-level courses, "Research Methods" and "Research Methods Lab," as "second-level fundamentals of the discipline" courses. The University of Arkansas–Little Rock also has instituted a portfolio system of assessment that includes seven required entries in the areas of statistics, methods, theory, applied, field placement, independent study, and other electives, each keyed to specific course objectives.

At Rowan College of New Jersey, traditional course sequences are being replaced with "program models" correlating with career goals. The sociology major at Charleston also integrates a critical and historical perspective on the discipline in its introductory course.

Methodologies are being introduced earlier in the major and reinforced throughout, giving students repeated and increasingly more sophisticated opportunities to apply the methodologies of the discipline.

This course is framed around the discipline's distinctive way of dealing with themes common to the social sciences.

Manhattan College's sociology department involved students in a large-scale investigation using various sociological methods to evaluate student experiences in the major. Students designed surveys and conducted focus interviews. As a result of information collected and analyzed by the students, the program now has correlated its curriculum tightly to a revised statement of goals.

As a result of these student investigations, the program has increased its emphasis on field research methods, which are introduced in lower- and middle-level courses and then used in a senior seminar in which students do an original research project. The department has also compiled a comprehensive set of resources on career opportunities, graduate school information, and internship and field placement experiences.

MANHATTAN COLLEGE
Sociology and Anthropology Instructional Goals

A. Substantive Knowledge

1. What are the major institutions of American society and other societies, how do those institutions operate, how are they interrelated, and how do they change?
2. What are the major social groups within and across societies (especially genders, racial/ethnic groups, social classes), how do they interact today with each other economically, politically, culturally, etc., and how have they interacted in the past?
3. What are the main similarities and differences between American society and other societies in structure and culture and processes?
4. What are the main social problems facing the United States, what are their causes, and what are their solutions?
5. What are the main findings, research problems, theoretical perspectives, and research methodologies in sociology and anthropology and how do these differ from those in other disciplines in the social sciences, humanities, and natural sciences?
6. What are the careers to which sociology and anthropology provide entree, how does one go about entering those careers, and how are sociology and anthropology used in a wide variety of occupations?

B. Skills to be Developed

1. Sociological perspective: the ability to formulate a problem in sociological and anthropological terms—recognizing the structural nature of social life—and to translate it into researchable questions.
2. Social research: the ability to conduct quantitative and qualitative research on social institutions, practices, and social groups in order to develop new knowledge and test validity of existing knowledge.
3. Critical thinking: the ability to determine the logical and empirical validity of truth claims made and data cited in the mass media, governmental announcements, scholarly studies, etc.
4. Life planning: the ability to analyze how social institutions are shaping one's life and the ability, therefore, to overcome social obstacles to achieving one's life goals.
5. Linguistic skills: the attainment of competence in spoken and written English.

C. Attitudes

1. An informed, nonprejudicial understanding of other groups in American society and of other societies.
2. A critical, reflective understanding of existing social practices and institutions in the U.S. and other societies. That is, we wish to overcome an unreflective acceptance of our own social institutions and practices and an unreflective rejection of those in other societies.
3. A spirit of social service and cooperation in which students are committed to addressing in their vocational and avocational lives the main social problems facing our nation.
4. A spirit of democratic citizenship in which students are committed to actively and intelligently participating in our society's decision-making processes in politics, the economy, etc.

PHYSICS

Most of the physics departments in the project significantly revised and clarified their goals for the major with input from students. Beyond this clarification of purposes, the incorporation of new technologies into the classroom, changes in organization of laboratory work, and changes in sequencing have all driven re-form efforts at these institutions.

Departments in the project also emphasized:

- the development of more research and internship opportunities for students;
- explicit connections between the major and issues of importance in general education programs in the sciences;
- greater use of collaborative-learning models; and
- societal uses of science-based technologies as themes to organize capstone courses and to illuminate for students connections to other disciplines which they may be studying.

In most physics departments, general education or core requirements lend themselves to the development of physics courses for non-majors, but also allow the relation of physics to general education to be made more explicit than in many departments and often with links to specific goals of the major.

Several departments developed comprehensive guides to their majors. At the College of Charleston, the physics handbook incorporates a normative statement, a statement of organizing principles, course requirements, career advice, guidance for the required senior research project, check lists, and suggested courses in humanities departments of interest to physics majors.

Sequential Reorganizations

Many departments in the project reorganized levels of instruction, most notably introductory courses and summative experiences. At Rowan College of New Jersey, the introductory restructuring now provides a more active experiential learning environment as well as extensive use of microcomputers. The introductory course also emphasizes collaborative learning techniques. This new course, "Physics of Everyday Life," introduces physics conceptually rather than mathematically and is seen by the department as a "gate-opener" rather than as a "weed-out" course. Rowan College of New Jersey has also developed a series of recommended courses to be taken at the introductory and middle levels designed as mathematics bridges to higher-level courses to ensure sufficient skills preparation for upper-level courses. Iona College has clari-

IONA COLLEGE
The Physics Major Programs

SCIENCE CORE

Calculus I, II
Chemistry I, II
Calculus III
Differential Equations

MAJOR-RELATED

Mathematics or Computer Science Electives [2]
Mathematics or Computer Science Electives [2]

PHYSICS MAJOR

Physics I, II
Mathematical Mechanics I, II
Electronics

Modern Physics I
Electricity and Magnetism I, II
Modern Physics II
Computational Physics
Statistical and Thermal Physics
Research I, *II*
Quantum Mechanics
Physics Seminar
Seminar in Science, Technology, and Society

APPLIED PHYSICS MAJOR

Physics I, II
Mathematical Mechanics I
Electronics
Digital Logic
Modern Physics I
Electricity and Magnetism I, II
Modern Physics II
Physics in Biology and Medicine
Statistical and Thermal Physics
Internship I, *II*
Computational Physics
Physics Seminar
Seminar in Science, Technology, and Society

Recommended electives are in italics. All other courses are required.

fied its course sequencing and has developed two tracks to the newly revised major program.

Connecting Learning

Several departments made progress in helping students connect their learning experiences inside and outside the major and in providing some critical perspective on the discipline. At Jacksonville University, several interdisciplinary courses have been developed. Using faculty from both the history and the physics departments, a new course on "The Atomic Bomb" was recently piloted. With the assistance of an equipment grant from the National Science Foundation, a new course was also developed combining introductory physics and calculus into a single integrated class. The course, "Computer-Assisted Laboratory in Physics and Calculus," is a two-semester sequence which presents the fundamental concepts of first-year physics and calculus as a unified whole. The class is team-taught by faculty from mathematics and physics/engineering.

The incorporation of new technologies into the classroom, changes in organization of laboratory work, and changes in sequencing have all driven re-form efforts.

Capstone courses at several departments bring together majors from all fields of science. Iona, for instance, has developed an interdisciplinary capstone course, "Seminar in Science, Technology, and Society" that brings together science majors from the departments of biology, chemistry, and physics for the first two hours and allows for integrative and clarifying thought. The second two hours are devoted to integrative material specific to each student's own major. Faculty members in the project realized that a core course on science and technology developed for non-majors offered material on the place of science in society that majors also needed at a more sophisticated level in their programs. This senior capstone course, then, allows science majors to reflect on the societal implications of their work in an integrative, interdisciplinary capstone course linked to a discipline-based senior seminar. The capstone course at Rowan College of New Jersey, "Advanced Laboratory and Topics in Physics," provides students with the opportunity to use real-world apparatuses to synthesize their knowledge with real

JACKSONVILLE UNIVERSITY
Computer-Assisted Laboratory in Physics and Calculus
MATH 131/PHYSICS 132

In this interdisciplinary course team-taught by faculty members from the physics and mathematics departments, students will work together to explore and develop the basic principles of electricity and magnetism, along with underlying mathematical principles of calculus, using computer-based technology as a partner and assistant. The two sciences of physics and calculus have common historical roots in the attempt to describe and explain change and motion. Students will pursue this area from the standpoint of solving problems. Students will work both alone and in teams to solve problems and formulate ideas which will develop into the basic physical laws and mathematical methods used to describe the behavior of electricity. By the end of the semester, students will have covered all the topics and material of traditional physics and calculus classes and more, and will have a better sense of how the two subjects relate to and draw upon each other.

Uses of Technology

Classes meet for two hours, three times a week. There, students will explore problems and develop new ideas, using computer technology to help work through and test ideas. The course uses a number of software packages, all of which are in common use by practicing scientists and mathematicians. These packages help students to visualize things and explore ideas, free of number crunching. Computers also will be used to write lab reports and presentations.

Lab Component

Labs will meet in the same physics laboratory as the other classes. We will conduct labs designed to enhance concepts developed in class and to focus on the methodology of science. Computers will be in the lab, too, and will be used in acquiring, storing, and analyzing data. Lab reports will be written up on the computers in the classroom, where equipment can be used to scan pictures and incorporate charts and graphs into reports.

Portfolio Component

Students will keep a portfolio of work in the class, including special homework problems, lab reports, tests, and other things of interest. Students are encouraged to think of portfolios as documentation of what they have accomplished over the course of the two semesters.

problems and to develop written and oral skills in presentations and reports.

Like many departments, the department at the University of Arkansas–Little Rock has used undergraduate research and internship opportunities to enable students to make connections across disciplines and to provide them with opportunities to present their work publicly.

Several departments made progress in helping students connect their learning experiences inside and outside the major and in providing some critical perspective on the discipline.

Rowan College of New Jersey has adopted a community-learning model throughout its major. Jacksonville University also incorporates problem-solving groups into various courses that also include public group presentations by students.

IONA COLLEGE
Course Outline for BIO, CES, CHM, PHY 451
Seminar in Science, Technology, and Society

Course Description

A seminar experience for senior science majors that explores the interplay of science, technology, and society. Students will present and discuss perspectives based on the humanities and social sciences in the context of selected science case studies and will compose new case studies which illustrate the human dimensions of the scientific endeavor. *This course is required of all majors in senior year. This course and the 450 seminar course together satisfy the capstone graduation requirement.* (2 hours)

Text

The Culture of Science: Essays and Issues for Writers. eds. John Hatton and Paul B. Plouffe. (MacMillan, 1993).

Student Audience

This course is open only to seniors majoring in biology, biochemistry, chemistry, computer electronics science, interdisciplinary science, or physics; it is required of them for graduation. Normally it will be taken by a student concurrently with the one-credit senior seminar in the major field (BIO 450, CES 450, CHM 450, PHY 450).

Faculty

The course will be staffed by the faculties of the biology, chemistry, and physics departments. It will be team-taught, with the teaching team sharing responsibility for the assignment of course work, the coordination of student presentations, the reading of student papers, and for insuring that all student grades are assigned on an equitable, normalized basis. The professors will serve as presenters and resource faculty for the seminar sessions and will also guide students in the development of their presentations and the preparations of their papers. It is anticipated that all members of the science faculties will periodically participate in the teaching of this course.

Procedures

The course will be conducted in the spirit of participatory study and discussion characteristic of a seminar. There will be one two-hour meeting per week. Most of these meetings will be student led. Students will be prepared for their roles by prior meetings and discussions with faculty members. All meetings of the seminar will involve student discussion based on previously assigned readings and related questions. Students will be expected to have completed all readings prior to a meeting and, as they are seniors who have essentially completed the college core curriculum and the greater part of their studies in the major field, they are expected to have a great deal to contribute to the development of course topics.

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BIOLOGY AND ENVIRONMENTAL STUDIES

In the fields of biology and environmental studies, several factors drove re-form efforts:

- pedagogical innovations including collaborative and problem-based learning;
- increased and more integral use of new technologies in the classroom including computer tutorials, computer bulletin boards, interactive video disks, laser disks, DNA synthesizers, and ultra centrifuges;
- increased opportunities for internships and field-based research, including the use of local and campus habitats;
- attention to students' learning and career goals to guide changes in major structures;
- development of integrative capstone courses; and
- maintenance of portfolios for students to track their own progress and to serve as a basis for program assessment.

Revised goals statements from participating departments address knowledge, skills, and values. All clarified the relations between introductory courses and more advanced work in the program. Manhattan College's biology department now emphasizes small interactive classes instead of the traditional large lecture. The one-year introductory biology sequence at Manhattan can also now be started in the spring as well as in the fall to facilitate entry into the program. Western Michigan University focuses on "conceptual mapping of complex environmental problems, simulating inquiry and developing vocabulary" in its introductory course.

Jacksonville University's redesigned introductory course also takes an environmental perspective and makes significant use of the local surroundings of the campus. Because the course is both the first course for majors and often the only laboratory course taken by non-majors, two concepts guided the course's revision—"the need to excite both majors and non-majors about the immediacy of biology and the desire to emphasize the department's strengths." The course is team-taught by the entire biology faculty, and laboratories are based on the environment on and around the Jacksonville University campus. Students use laboratory sessions to explore the ecology of campus habitats; knowledge gleaned in these labs is then incorporated in regular classes as a base framework for topics covered. Also at the introductory level, "topic discussions, presentations, critical thinking projects, and computer simulations are presented for students to highlight issues and research efforts by biologists with many specialties." This introductory course also emphasizes collaborative learning.

At the middle level, Western Michigan University's courses focus on "information and conceptual frameworks concerning both the natural world and the world of human institutions." Overall redesign of the major at Western Michigan University has further emphasized more integrated courses.

All of the institutions in the project developed capstone experiences for students. At Jacksonville University, students can choose either a capstone course, an independent study, a research project, or an internship, all aimed at the synthesis of knowledge of the field. The department has taken the promotion of undergraduate research and internships as a major priority. These activities further the department's goal of allowing

WESTERN MICHIGAN UNIVERSITY
Biology Major
Comparison of Previous and Newly Re-Formed Major

Level	Previous	Newly Re-formed
Introductory	Animal Biology Plant Biology Cell Biology	Molecular/Cellular** Evolution/Organismal** Genetics**
Intermediate	Genetics Physiology* Ecology	Microbiology or Botany Physiology* Ecology
Advanced	three from unrestricted list	two from cluster groups
Capstone	None	Capstone Experience
Total Hours	thirty-six	thirty-four

*Plant or Human Physiology
**Integrated Courses

Old Cognates: math through calculus, chemistry through biochemistry for biomedical sciences majors, chemistry through one semester organic for biology and secondary education majors.

New Cognates: math to include calculus and statistics, biochemistry required of all majors.

students the opportunity to explore and extend their education through various non-classroom activities. The department formed a research advisory council in fall 1993 with participation by experts from industry, the medical profession, and governmental agencies. The council made it possible to expand the number of research opportunities for students. Research is also promoted at Jacksonville University by an undergraduate research symposium, at which students present papers, and an undergraduate research journal, featuring original work by Jacksonville students.

The environmental studies program at Western Michigan incorporates a team-taught integrated capstone experience for all majors. This semester-long course involves a single problem-solving/planning simulation. Students are evaluated in terms of their ability to function individually and with their colleagues in a simulated professional work environment.

Cooperative work is built into programs at all of the institutions in the project. Manhattan College has incorporated problem-based learning into both middle-level and especially senior-level colloquium courses. Environmental science majors at Jacksonville University maintain a portfolio with which students can track their own progress and the department can use as a means of assessment.

In response to student's expressed learning and career goals, the department at Manhattan College designed a new curriculum for the B.A. degree distinguishing it more explicitly from the B.S. degree. The department approved a different B.A. curriculum designed for students who will not pursue postgraduate study in biology, but who will enter a multidisciplinary career combining biology with a nontechnical field such as management, sales, or writing. The interdisciplinary nature of the new program is implemented by reducing the science requirements for the B.A. compared to the B.S., but requiring the B.A. students to complete a minor or two concentrations in nontechnical fields.

WESTERN MICHIGAN UNIVERSITY ENVIRONMENTAL STUDIES PROGRAM

PROGRAM INTRODUCTION

ENVS 110: Introduction to Environmental Studies

CONCEPTUAL FOUNDATIONS

ENVS 210: Environmental Biology	ENVS 220: Environmental Physical Science	ENVS 230: Environmental Earth Science	ENVS 240: Cultures and Global Change	ENVS 250: Political Economy of the Environment

SKILLS AND VISION

ENVS 320: Major Environmental Writings	ENVS 350: Environmental Problem Solving	ENVS 360: Values and Sustainable Society

APPLICATIONS

A Minimum of Four Credits From the Following Five Courses

ENVS 401: Selected Environmental Topics	ENVS 410: Appropriate Technologies and Sustainability	ENVS 420: Internship	ENVS 430: Environmental Projects	ENVS 440: Field Experience

REQUIRED CAPSTONE

ENVS 450: Senior Seminar in Environmental Studies

MATHEMATICS

Re-forms undertaken in mathematics departments focused on two central themes: collaborative and connected learning and the impact of changing technology. Computers and graphing calculators, collaborative learning and problem solving, and pedagogical innovations have all added new vitality to mathematics programs. Innovations in technology have resulted in significant rethinking of content and pedagogy in mathematics courses across departments in the project.

The mathematics departments in the project made changes in goals, structures, and methods of assessment drawing on consultation and recommendations from advanced students and alumni. Important changes include:

- more accurate analysis of student capacity as they enter the major and attention to what will engage them early in the major;
- greater attention to what kinds of knowledge students will need in a changing workplace;
- integration throughout course sequences of collaborative and group methods of learning;
- emphasis on oral and written expression of mathematics content for clarity and relevance;
- co-curricular activities that reinforce students' becoming part of the "culture" of the department;
- identification of field or internship experiences at which students can sharpen their research methods and apply what they have learned;
- greater attention to problem solving especially in capstone courses; and
- integration of a critical perspective on the major especially in capstone courses.

Technology in the Classroom

Graphing calculators have become a requirement for courses in most pre-calculus and calculus courses. Faculty members at Rowan College of New Jersey note that "classes using the graphing calculator engage in group problem solving as a regular part of the classroom experience." At Manhattan College, including the use of the computer in the introductory class has led to a restructuring of the course that incorporates the software of computer algebra systems. Faculty members at Manhattan plan to use "computer modeling" as an integrating theme throughout their applied courses. At Dickinson College, all first-level courses meet in the computer laboratory, "with the computer either driving or being a necessary tool.... While traditional lecturing hasn't totally disappeared, it is certainly being downplayed."

JACKSONVILLE UNIVERSITY
Summary of Re-forms in Mathematics

- Revision and clarification of departmental goals and objectives
- Review of objectives of individual courses for coherence and consistency with program goals
- Addition of capstone course in problem solving as an integrative experience
- Revision of program assessment:
  - field testing of senior exit examination
  - use of capstone course as tool for program assessment
- Increased emphasis on involving students in the department:
  - revitalization of the student mathematics society
  - consultation with student groups on curriculum revision, pedagogy, and departmental activities
  - participation in the Mathematical Contest in Modeling
  - presentation of student papers at national and state conferences
  - refurbishing of student lounge
- Renewal of emphasis on undergraduate research, including:
  - early identification of talented students
  - provision of research opportunities both on and off campus
- Incorporation of graphing calculators in pre-calculus
- Implementation of a computer algebra system in calculus and scheduling of all calculus classes in a computer classroom
- Increased use of collaborative learning and group projects in calculus and other courses and the development of lab manuals for calculus sequences
- Piloting of experimental course combining freshman-level physics and calculus
- Revision of midlevel offerings to emphasize problem solving and to introduce students to advanced technology specific to the discipline
- Change of calculus sequence from four three-semester-hour courses to three four-semester-hour courses
- Offering of an interdisciplinary course, "The Infinite," team-taught by faculty from mathematics and philosophy
- Establishment of internships, especially with the Mayo Clinic
- Agreement to join a pilot program for a new introductory course in mathematics developed by the Consortium for Mathematics and its Applications (COMAP)

Student Participation and Connected Learning

Jacksonville University has initiated several courses that are integrative and encourage students to connect learning across disciplines. A new course, "The Infinite," was offered for the first time in spring 1993. Team-taught by faculty from philosophy and mathematics, the course used the concept of infinity to elucidate fundamental concepts of both metaphysics and mathematical analysis and to connect the two areas of inquiry.

Faculty members at Manhattan College have also revised the way in which they teach a sophomore-level course required of all engineering, physics, chemistry, and mathematics majors. "Differential Equations" is now taught as a sophomore-level capstone experience. Teachers ask students in this course to apply the three mathematical techniques traditionally taught in "Differential Equations"—algebraic, numerical, and qualitative (graphical) skills—to a specific problem. Faculty members stress modeling, primarily of biological or environmental problems, and in a final project expect students to work collaboratively using all three techniques. In the course offered during the spring of 1994, students were asked to solve a bear control problem (see page 22 for details on the project).

Students learn by doing and reflecting on what they have done.

Changing the Way Math is Taught

The mathematics department at Dickinson College uses a "Workshop Mathematics Program" in its introductory mathematics and statistics courses, "Quantitative Reasoning," "Statistics," and "Calculus with Review I and II." Each course is seen as a gateway to the further study of mathematics and enables students to develop their skills. These courses are designed for students who may not yet be prepared to enter the regular calculus sequence. The program helps students to:

- develop an understanding of important mathematical concepts;
- be able to apply mathematics to problems in other disciplines;
- acquire both the self-confidence and the intellectual skills needed to learn more mathematics; and
- enjoy the process of learning mathematics.

All classes in the program are held in a microcomputer-equipped classroom/laboratory. In this workshop environment formal lectures are abandoned. Instead, students learn by doing and reflecting on what they have

IONA COLLEGE
Mathematics Department Sequencing

Introductory Courses
Required

MTH 231	Calculus I
MTH 232	Calculus II
MTH 233	Calculus III

Transitional Course
Required

MTH 250	Linear Algebra

Intermediate Courses
Required

MTH 302	Differential Equations
MTH 410	Advanced Calculus
MTH 421	Advanced Algebra I
(Skills Validation in Writing and Critical Thinking)	
MTH 432	Probability and Statistics I

Advanced Courses
One Required—Two as Electives

MTH 415	Complex Variables
MTH 422	Abstract Algebra II
MTH 433	Probability and Statistics II

Additional Electives
For B.A. one required
For B.S. three required

MTH 240	Theory of Numbers
MTH 300	Mathematical Mechanics
MTH 310	Discrete Mathematics
MTH 403	Geometry
MTH 406	Introduction to Topology
MTH 411	Vector Analysis
MTH 491	Special Topics in Mathematics

Capstone Experiences
Required

MTH 440	History and Foundation of Mathematics

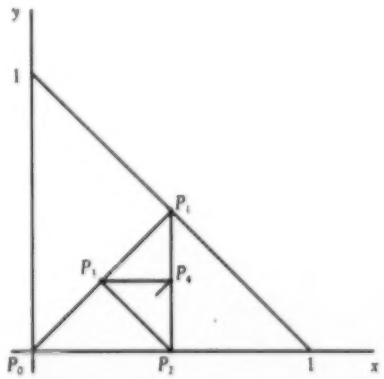
done. Initially new ideas and concepts are introduced in an informal and intuitive way by the instructor without any formal definitions or examples. Students then work collaboratively on specially designed tasks exploring mathematical ideas and finding ways to approach and solve problems. As professor James M. Hoefler of Dickinson College described it: "Rather than covering a wide swath of material superficially, [the courses] focus on developing in students the ability to master the core concepts so that the students can think on their feet and develop a solid intuitive sense for the material that will endure long after the semester ends." The materials used in the courses emphasize the use of real-world applications and genuine data; they also make use of a variety of software packages, ranging from generic tools such as a statistical package and a computer algebra system to more distinctive packages such as Micro-computer Based Laboratory Tools and the programming language ISETL.

JACKSONVILLE UNIVERSITY
Capstone Problems Seminar in Mathematics

In this three-credit course, students work alone and collaboratively on solving problems posed by faculty members. Faculty members participate in the activities. Problems like the one illustrated below integrate the major concepts and techniques covered in the major program. Students present solutions both orally and in writing. The course involves several faculty members in designing problems and in teaching.

Sample Problem:

All the lines in the sketch have slope 0, 1, or -1, or are vertical. What point do the points P_n approach?



For a natural number n, let $t(n)$ be the sum of the divisors d of n in the range $1 \le d < n$ with n/d being squarefree. Is there an integer n for which the sequence n, $t(n)$, $t(t(n))$,... is unbounded?

MANHATTAN COLLEGE
Differential Equations Course
The Acadia National Park
Bear Population Control Project

Purpose

The purpose of this project is to simulate what it is like to work as an engineer, scientist, or mathematician in industry and/or academia. You will be a member of a team of three or four students who will act collaboratively as a private consulting group.

Problem Description

We shall suppose that the administration of Acadia National Park, in Maine, is seeking to hire a group such as yours to serve as consultants on environmental questions.

The Problem: The park now has x = 10 bears and the bear population growth is currently being modeled by the logistic equation (with t measured in years):

$x' = .001x(100-x)$

A tribe of Native Americans who live in the park have requested permission to kill a number of bears each year.

The park administration decides to honor the request and therefore changes the equation which models the growth of the bear population. The new model they will use is the Schaefer Model:

$x' = .001x(100-x) - hx$

h is an unknown constant with units of 1/time. The term hx is called the harvesting term or the yield term; it represents the number of bears to be removed from the population each year.

You are required to demonstrate the ability to solve the problem graphically, numerically, and symbolically. Bear in mind that a mathematical model is hardly ever an exact description of reality and therefore the answers that it produces must often be tempered by sound reasoning and good judgment.

Students' Mission

1. To determine the value of h which optimizes the yield and does not cause the bear population to become extinct.
2. To write a report presenting your solution to the problem and your recommendation to the park administration.
3. To include in the report a schedule which indicates the number of bears which the Native Americans can kill in each successive year, and what the total bear population should be in that year. This will enable the park service to determine whether or not your consulting group should obtain the contract for monitoring the project.
4. To present the report to the class.

ACKNOWLEDGMENTS

The information gathered here is compiled from final reports submitted by department liaisons and project directors at each of the eight lead institutions and two surveys administered to faculty members involved in the project.

The report was written by **Debra Humphreys**, AAC&U programs associate, in collaboration with **Carol Geary Schneider**, executive vice president of AAC&U and director of the entire Re-forming Majors project. AAC&U would like to thank all the deans who coordinated the projects on their campuses and the many faculty members in departments who undertook the curriculum initiatives described here. In addition, we would like to thank **Robert Shoenberg**, who served as a consultant to each of the institutions and the majority of departments participating in the project, and **Bridget Puzon**, AAC&U academic editor, who assessed and summarized the data in the surveys. We would also like to thank **Cindy Olson**, AAC&U production editor, for her patience, hard work, and cheer under much pressure to meet our publication deadline.

Finally, we thank the U.S. Department of Education, Fund for the Improvement of Postsecondary Education, for its financial support and especially our Program Officer, **Joan Straumanis**, for her continued guidance on and support for the project.

AAC&U PUBLICATIONS ON RE-FORMING MAJORS:

The Challenge of Connecting Learning
Shaped in dialogue with faculty leaders from a dozen learned societies, *Challenge* finds field "coverage" an obsolete goal for college majors and "study-in-depth" too limited. In this important contribution to the literature of liberal education, *Challenge* argues that the major should be a matrix for integrative and collaborative learning, not a cocoon for premature specialization. To qualify as liberal learning, says *Challenge*, majors must teach students how to work with others to explore significant questions, how to test the limits of any initial perspective, and how to integrate different parts of their learning, within and beyond the academy.
33 pages $12.

Reports from the Fields
In an unprecedented study initiated by AAC&U, twelve learned societies worked in concert to examine their respective majors, identify goals for introductory, intermediate, and advanced work, and recommend ways to foster integrative and collaborative learning. This single volume provides executive summaries of the twelve reports: biology, economics, history, mathematics, philosophy, physics, political science, psychology, religion, sociology, women's studies, and interdisciplinary majors.
226 pages $20.

Program Review and Educational Quality in the Major
This very practical handbook translates AAC&U's national study of college majors into guidelines for program review. Written to assist faculty members embarking on program review and/or assessment of student learning, the handbook describes key elements of effective major programs, provides a protocol for departmental self-study and recommends ways of including outcomes assessment in program review.
32 pages $12.

For more information call CydCherise Fields
AAC&U Publications Desk
(202) 387–3760

Prices do not include postage and handling.

INSTITUTIONS IN RE-FORMING THE MAJOR PROJECT*

Following publication of its earlier reports on "Liberal Learning and the Arts and Sciences Major," AAC&U held two national conferences on the central recommendations emerging from the learned societies' collaborative review of the major. The eighty institutions that sent five or more faculty members to one of these conferences were then eligible to apply for selection as a "lead institution" working to strengthen majors as liberal learning. The selected "lead institutions" listed below each received out of project funds provided by the U.S. Department of Education, Fund for the Improvement of Postsecondary Education, $20,000 to support their curricular efforts in the major. Each contributed substantial funds of its own as well. The faculty members listed coordinated projects in their respective departments and the deans listed coordinated the projects campuswide.

College of Charleston (Charleston, S.C.)
Samuel M. Hines, (Dean of Humanities and Social Sciences)
Lynne Ford (Political Science); *Ken Fronabarger* (Geology); *Chris Hope* (Sociology/Anthropology); *Joseph Kelly* and *Nan Morrison* (English); *Bill Kubinec* (Physics); *Elizabeth A. Martínez* and *Jozef Modzelewski* (Languages); *Amy Thompson McCandless* (History); *Robert Mignone* (Mathematics); *George Pothering* (Computer Science)

Dickinson College (Carlisle, Pa.)
Margaret Garrett (Associate Dean of the College)
Bill Bellinger (Economics); *Clarke Garrett* (History); *Robert Ness* (English); *James Skelton* (Psychology); *Jack Stodghill* (Mathematics and Computer Science)

Iona College (New Rochelle, N.Y.)
Marie Ciardiello (Associate Dean of the College)
James Carpenter (Physics); *Mary Hughes* (Education); *Judyth Isserlis* (Speech Communication); *Joseph Morgan* (History); *James Murphy* (Physics); *Keitha Murray* (Computer Science); *Michael Palma* (English); *Dennis Schmidt* (Political Science); *George Thottam* (Communication Arts)

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Manhattan College (Rivérdale, N.Y.)
Mary Ann O'Donnell (Acting Dean, School of Arts)
Kevin Dougherty (Sociology/Anthropology); *Winsome Downie* (Political Science); *Peter Henderson* (Physics); *Lydia Panaro* (English); *Patrick Johnson* (Psychology); *G.B. Kirsch* and *F. M. Schweitzer* (History); *William Tramontano* (Biology); *Nevart Wanger* (Foreign Languages); *Kathryn Weld* (Mathematics and Computer Science)

Rowan College of New Jersey (Glassboro, N.J.)
Pearl W. Bartelt (Acting Dean of Liberal Arts and Sciences)
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University of Arkansas–Little Rock (Little Rock, Ark.)
Lloyd Benjamin, III, (Dean of the College of Arts, Humanities and Social Sciences)
Michael Anda (Political Science); *Chuck Anderson* (Writing and Rhetoric); *Ed Anson* (History); *George Ballard* (Computer Science); *Ron Boswell* (Music); *Doug Buffalo* (Sociology); *Gary Cawood* (Art); *Jeff Conally* (Earth Science); *Julianne Flinn* (Anthropology); *Mary Ann Garnett* and *Ed Anson* (Foreign Languages); *Howard Hodges* (Chemistry); *Alan Johnson* (Mathematics); *Frank Kenney* (Philosophy); *Ray Larson* (Theatre Arts); *Richard Lewis* (Biology); *David Luneau* (Engineering); *Linda Miller* (Psychology); *Mary Parker* (Criminal Justice); *Andre Rollefson* (Physics); *David Sedman* (Radio/TV/Film); *Carol Thompson* (Speech Communications); *Don Van Horn* (Liberal Arts); *Paul Yoder* (English)

Western Michigan University (Kalamazoo, Mich.)
Elise Bickford Jorgens (Associate Dean of Curriculum and Instruction)
Linda Borish (History); *Norman Carlson* and *Nancy Eimers* (English); *Sylvia Culp* (Philosophy); *Gyula Ficsor* (Biological Sciences); *David Hargreave* (Environmental Studies); *William Kern* (Economics); *Mark Kerstetter* (Computer Science); *Pete Renstrom* and *Chester Rogers* (Political Science)

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